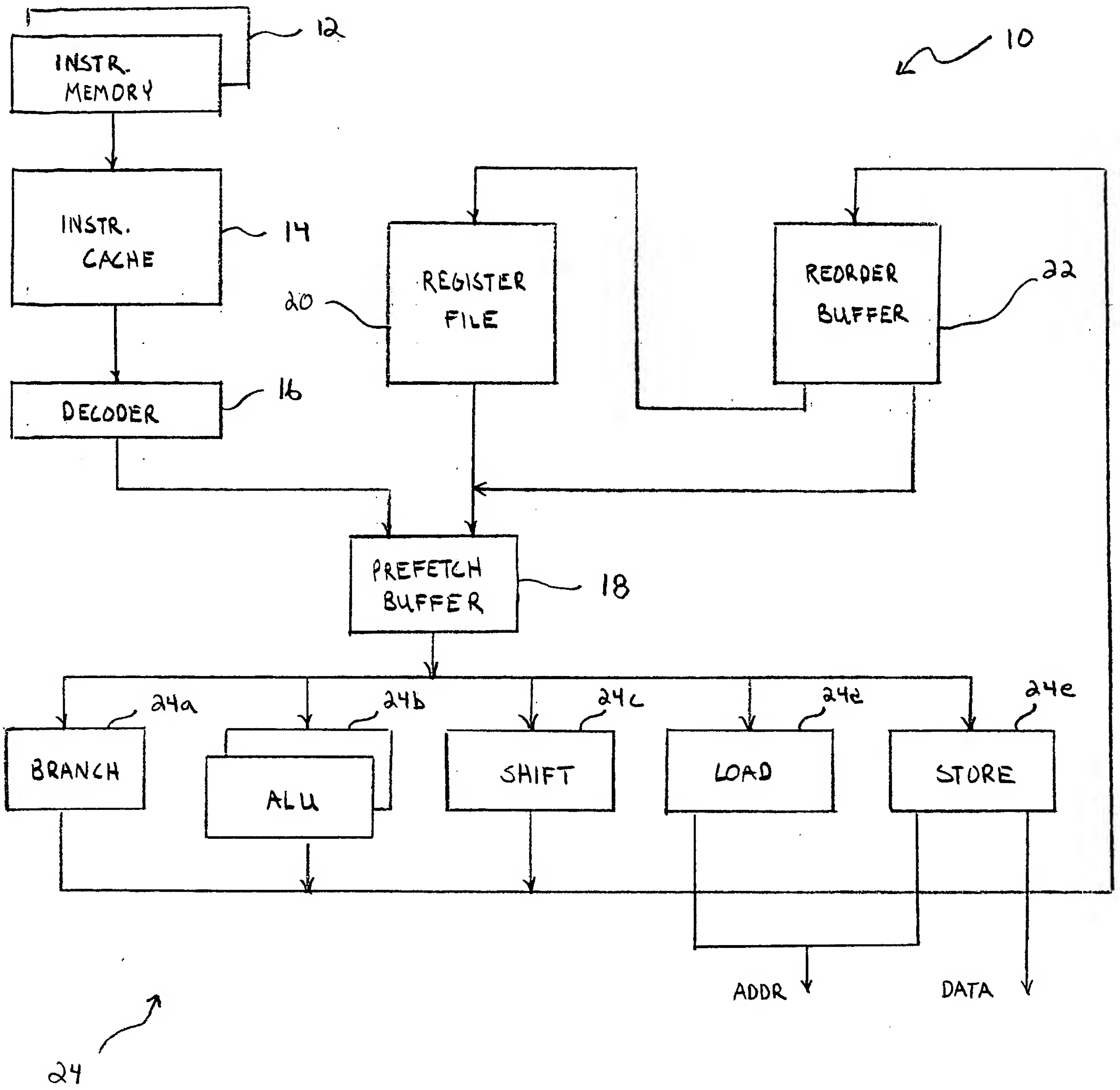

INSTR. MEMORY
12
10
INSTR. CACHE
14
REGISTER FILE
20
REORDER BUFFER
22
DECODER
16
PREFETCH BUFFER
18
24a
24b
24c
24d
24e
BRANCH
ALU
SHIFT
LOAD
STORE
ADDR
DATA
24

FIG. 1

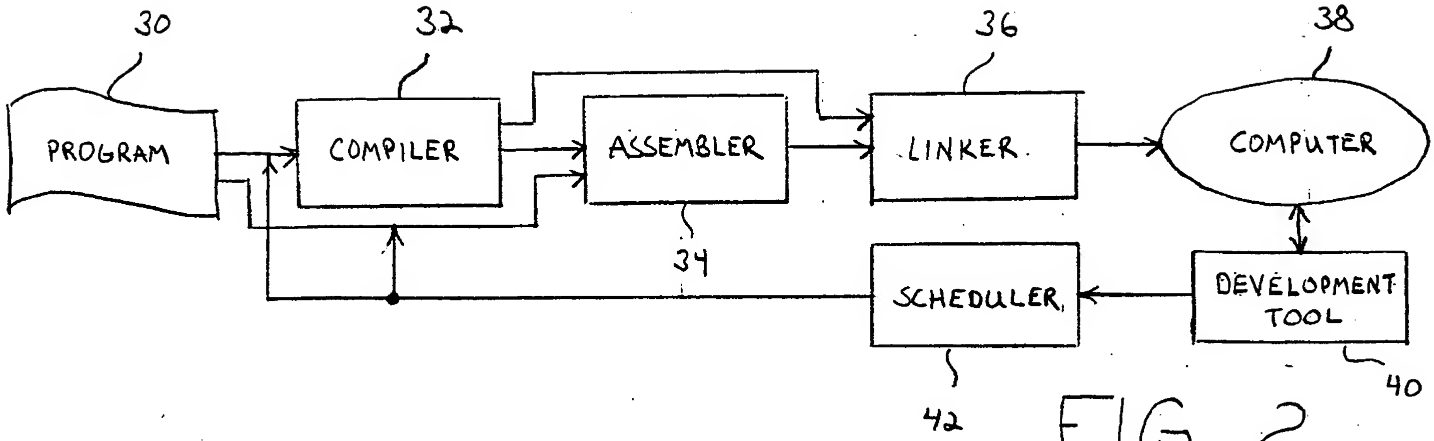

FIG. 2

```
*bp = (*bp & rm[offset]) | ((cd<<offset) & mask)

1:  const     tmp1,mask             ;load mask
2:  consth    tmp1,mask
3:  sll       tmp2,cd,offset        ;cd<<offset
4:  and       tmp2,tmp1,tmp2        ;(cd<<offset) & mask
5:  const     tmp1,_rm              ;base address rm
6:  consth    tmp1,_rm
7:  add       tmp1,tmp1,offset      ;address of rm[offset]
8:  load      tmp1,(tmp1)           ;rm[offset]
9:  load      bp,(&bp)              ;*bp
10: and       tmp1,bp,tmp1          ;*bp & rm[offset]
11: or        tmp1,tmp1,tmp2        ;final expression
12: store     tmp1,(&bp)            ;assign *bp
```

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Decode				Execute					Writeback		
I0	I1	I2	I3	ALU1	ALU2	SHF	LS	BRN	R1	R2	Cycle
1:const	2:consth	3:sll	4:and								1
5:const	6:consth	7:add	8:load	1:const		3:sll					2
9:load	10:and	11:or	12:store		2:consth				1	3	3
				4:and	5:const				2		4
				6:consth					4	5	5
					7:add				6		6
							8:load		7		7
							9:load				8
									8		9
				10:and					9		10
					11:or				10		11
							12:store		11		12

FIG. 3

Stage	Issue 1	Issue 2	Issue 3	Issue 4
Write Back	none	none	none	none
Execute	0x1000	0x1001	0x1002	0x1003
Memory 1	0x1006	0x1007	0x1008	none
Memory 0	0x100A	none	none	none
Address Generation	0x100B	0x100D	0x100F	0x1011
Read Data	none	none	none	none
Grouping	0x1013	0x1014	0x1015	0x1016
Fetch/Decode	0x1017	0x1018	0x1019	none

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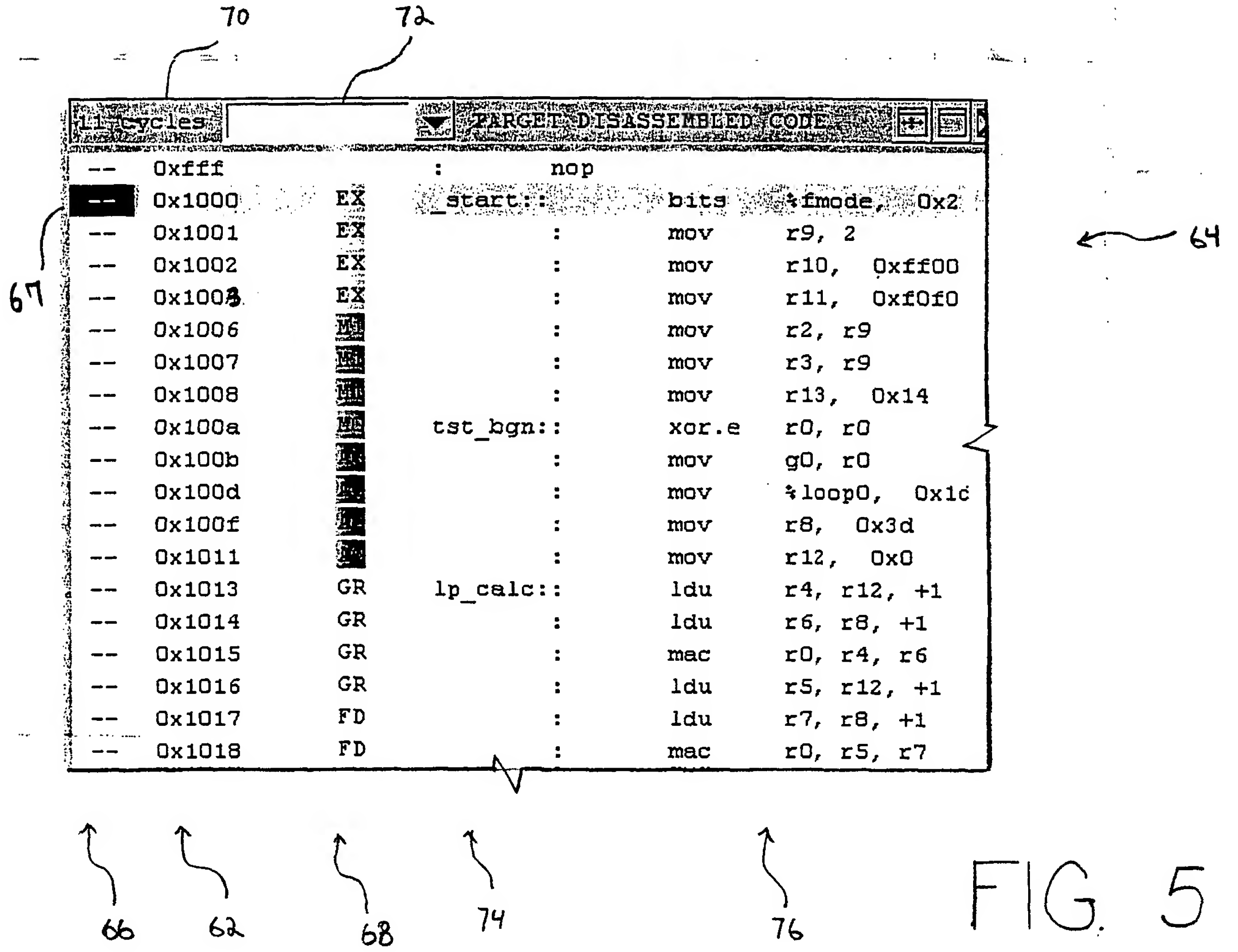
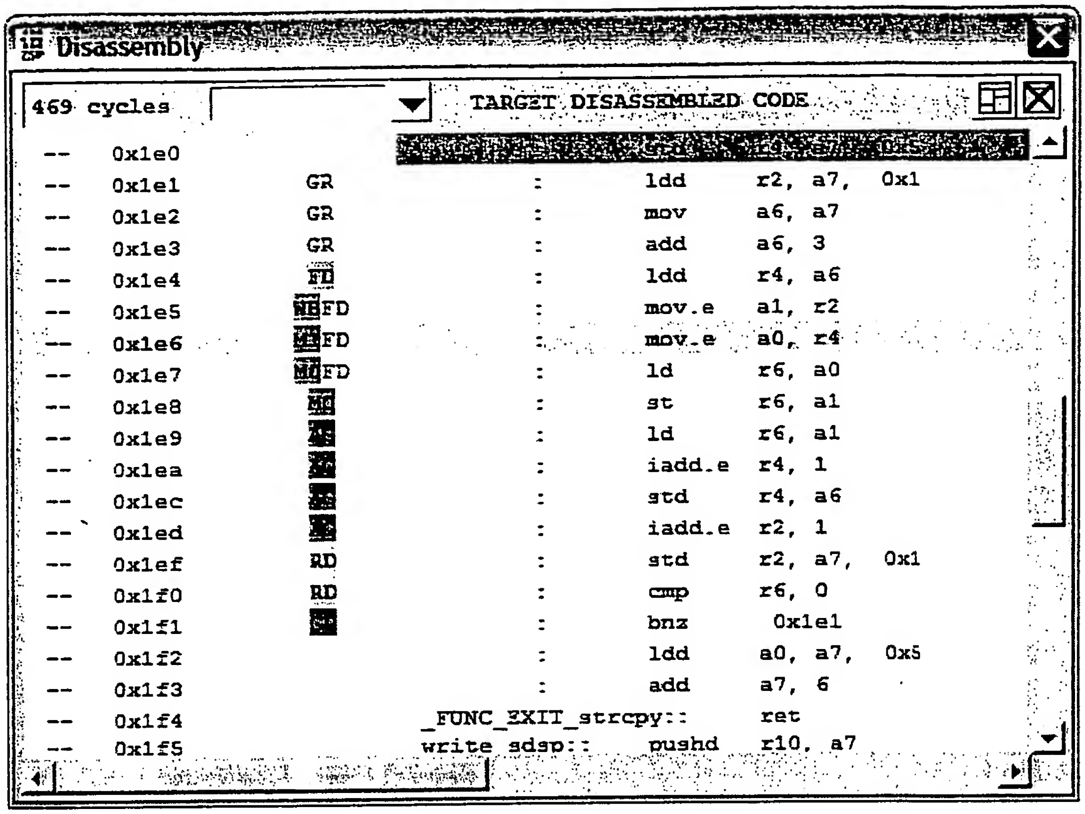
FIG 4



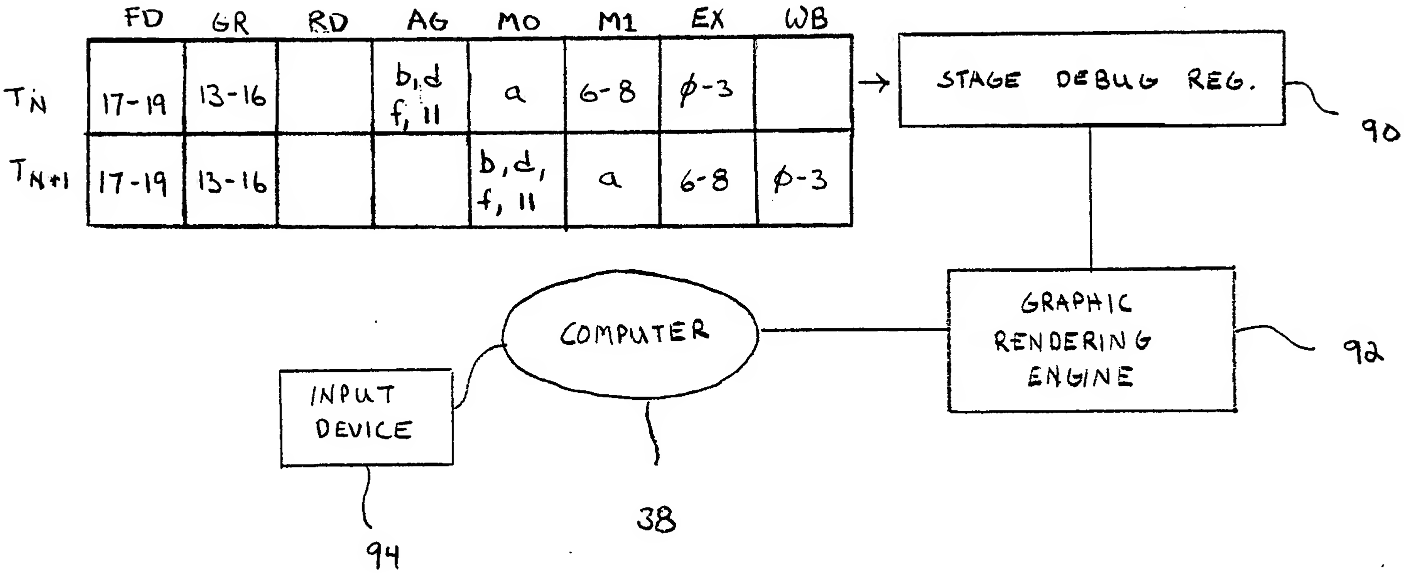
```
--   0xfff                    :        nop
--   0x1000       EX      _start::       bits     %fmode,   0x2
--   0x1001       EX             :       mov      r9, 2
--   0x1002       EX             :       mov      r10,   0xff00
--   0x1003       EX             :       mov      r11,   0xf0f0
--   0x1006       M1             :       mov      r2, r9
--   0x1007       M1             :       mov      r3, r9
--   0x1008       M1             :       mov      r13,   0x14
--   0x100a       M0     tst_bgn::       xor.e    r0, r0
--   0x100b       AG             :       mov      g0, r0
--   0x100d       AG             :       mov      %loop0,   0x1c
--   0x100f       AG             :       mov      r8,   0x3d
--   0x1011       AG             :       mov      r12,   0x0
--   0x1013       GR     lp_calc::       ldu      r4, r12, +1
--   0x1014       GR             :       ldu      r6, r8, +1
--   0x1015       GR             :       mac      r0, r4, r6
--   0x1016       GR             :       ldu      r5, r12, +1
--   0x1017       FD             :       ldu      r7, r8, +1
--   0x1018       FD             :       mac      r0, r5, r7
```

FIG. 5



```
469 cycles
--    0x1e0                                [illegible]  std    r10, a7,  0x5
--    0x1e1        GR                 :    ldd      r2, a7,   0x1
--    0x1e2        GR                 :    mov      a6, a7
--    0x1e3        GR                 :    add      a6, 3
--    0x1e4        FD                 :    ldd      r4, a6
--    0x1e5      WBFD                 :    mov.e    a1, r2
--    0x1e6      M1FD                 :    mov.e    a0, r4
--    0x1e7      MOFD                 :    ld       r6, a0
--    0x1e8        MO                 :    st       r6, a1
--    0x1e9        AG                 :    ld       r6, a1
--    0x1ea        [illegible]        :    iadd.e   r4, 1
--    0x1ec        [illegible]        :    std      r4, a6
--    0x1ed        [illegible]        :    iadd.e   r2, 1
--    0x1ef        RD                 :    std      r2, a7,   0x1
--    0x1f0        RD                 :    cmp      r6, 0
--    0x1f1        [illegible]        :    bnz       0x1e1
--    0x1f2                           :    ldd      a0, a7,   0x5
--    0x1f3                           :    add      a7, 6
--    0x1f4               _FUNC_EXIT_strcpy::   ret
--    0x1f5               write_sdsp::    pushd    r10, a7
```

FIG. 6



	FD	GR	RD	AG	MO	M1	EX	WB
T_N	17-19	13-16		b,d f, 11	a	6-8	ϕ-3	
T_{N+1}	17-19	13-16			b,d, f, 11	a	6-8	ϕ-3

FIG. 7